ANA-UM-500001-E-10

MB39C602 LED LIGHTING SYSTEM BULB 9W ZIGBEE CONTROL

USER MANUAL

FUJITSU

Revision History

Version	Date	Updated by	Approved by	Modifications
1.0.0	2012-8-17	Denny Deng		First Draft
1.1.0	2012-11-1	Allen Zhao		Second Draft

Specifications are subject to change without notice. For further information please contact each office.

All Rights Reserved.
The contents of this document are subject to change without notice.
Customers are advised to consult with sales representatives before ordering.
The information, such as descriptions of function and application circuit examples, in this document are presented solely for the purpose of reference to show examples of operations and uses of FUJITSU SEMICONDUCTOR device; FUJITSU SEMICONDUCTOR does not warrant proper operation of the device with respect to use based on such information. When you develop equipment incorporating the device based on such information, you must assume any responsibility arising out of such use of the information.
FUJITSU SEMICONDUCTOR assumes no liability for any damages whatsoever arising out of the use of the information.
Any information in this document, including descriptions of function and schematic diagrams, shall not be construed as license of the use or exercise of any intellectual property right, such as patent right or copyright, or any other right of FUJITSU SEMICONDUCTOR or any third party or does FUJITSU SEMICONDUCTOR warrant non-infringement of any third-party's intellectual property right or other right by using such information. FUJITSU SEMICONDUCTOR assumes no liability for any infringement of the intellectual property rights or other rights of third parties which would result from the use of information contained herein.
The products described in this document are designed, developed and manufactured as contemplated for general use, including without limitation, ordinary industrial use, general office use, personal use, and household use, but are not designed, developed and manufactured as contemplated (1) for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could have a serious effect to the public, and could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2) for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite).
Please note that FUJITSU SEMICONDUCTOR will not be liable against you and/or any third party for any claims or damages arising in connection with above-mentioned uses of the products.
Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.
Exportation/release of any products described in this document may require necessary procedures in accordance with the regulations of the Foreign Exchange and Foreign Trade Control Law of Japan and/or US export control laws.
The company names and brand names herein are the trademarks or registered trademarks of their respective owners.

Copyright © 2012 Fujitsu Semiconductor Design (Chengdu) Co. Ltd. All rights reserved.

1 Introduction

1.1 Purpose

This user manual describes how to use the demo, which is the LED bulb 9W with zigbee control dimming. With zigbee wireless controling, we can adjust the brightness of the LED bulb. Demo can support simultaneously or separately adjust the brightness of the two LED bulbs. The AC input rang is from 85VAC to 265VAC. LED load: 300mA / 9 pieces in series.

1.2 Reference Documents

ANA-UM-500002-E-10-LED_Driver_Board-Bulb_9W_PWM-Dimming;

MB39C602 Datasheet

2 Overview and Features

2.1 Overview

The LED Driver use MB39C602 as controller IC. And MB39C602 is a flyback type switching regulator controller IC. The LED current is regulated by controlling the switching on-time or controlling the switching frequency, depending on the LED load. It is most suitable for the general lighting applications, for example residencial LED lighting.

The MB95560H is general-purpose, single-chip microcontrollers. In addition to a compact instruction set, the microcontrollers of these series contain a variety of peripheral resources.

2.2 Features

MB39C602:

- High power factor in Single Conversion
- High Efficiency
- High Performance flyback converter.
- Worldwide AC input (85V-265V) and use Zigbee module as dimmer
- Low EMI switching topology
- Suitable for LED lighting application (3W-25W).
- Built-in under voltage lock out function
- Built-in over load protection function
- Built-in over voltage protection function
- Built-in over temperature protection function

MB95560H:

- F2MC-8FX CPU core
- Clock
- Timer
- LIN-UART
- External interrupt
- 8/10-bit A/D converter
- Low power consumption (standby) modes
- I/O port
- On-chip debug
- Hardware/software watchdog timer
- Power-on reset
- Low-voltage detection reset circuit
- Clock supervisor counter
- Dual operation Flash memory
- Flash memory security function

3 System Block and Installation

3.1 System Block

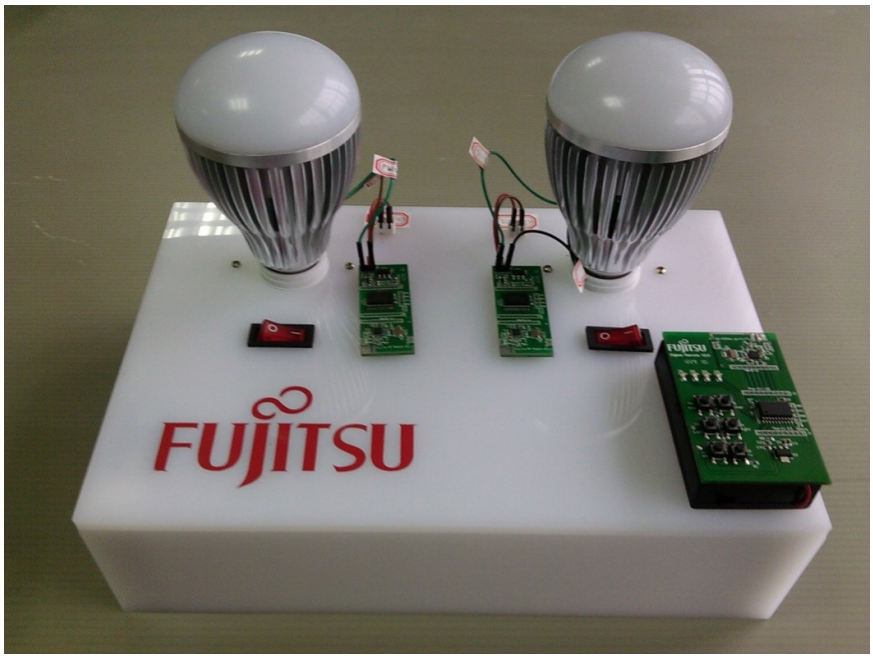


Figure 3-1: Photo of demo

This demo system is made up with 3 parts. They are power box module, led bulb and zigbee control/receiver block.

- Power Box Module

  This module consists of an electrical outlet, two bulb holders, a AC/DC(output:5V) module and two ON/OFF switchs. The Electrical outlet(a 1A/250V fuse in it) is the input of 85VAC--265VAC, and the lighting bulb is put in the bulb holder. The AC/DC(output:5V) is power for zigbee ricever, and it will work when power on.

  When the power on, using ON/OFF switch can turn on or off the lighting bulb. The detail is shown in figure 3-2.

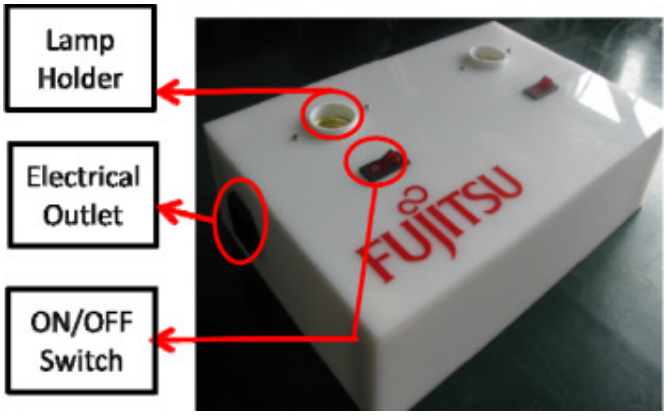


Figure 3-2: Power Box Module

- Lighting bulb Module

  The LED Driver Board is put in lighting bulb. It has a connector, which is for receive the PWM(0V-5V) signal from Zigbee receiver. The details are shown in figure 3-3 (a) and (b) .

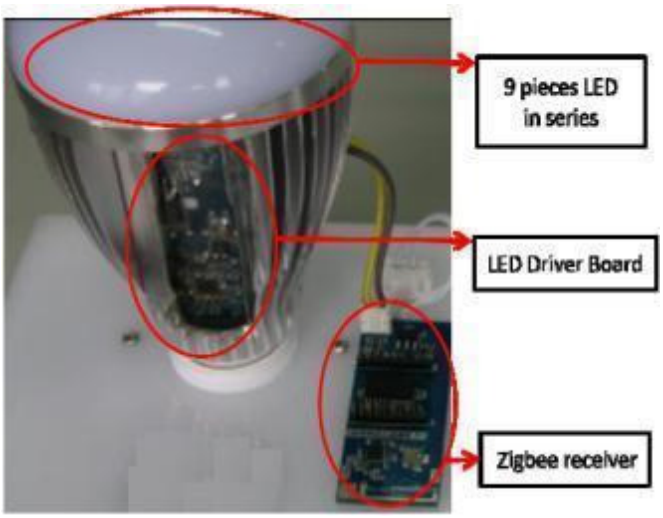


Figure 3-3: Lighting bulb Module (a)

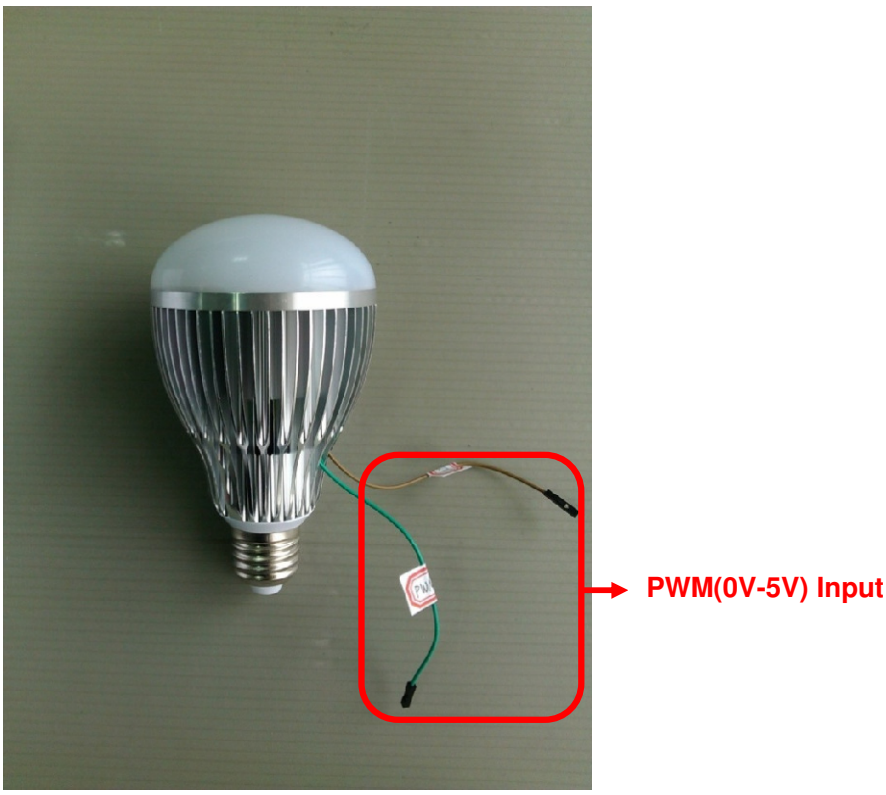


Figure 3-3: Lighting bulb Module (b)

- Zigbee Module

  This module consists of zigbee remote controller and receiver. But the zigbee receiver is connected to lighting bulb. The remote controller sends command to receiver with wireless. The detail is shown in figure 3-4.

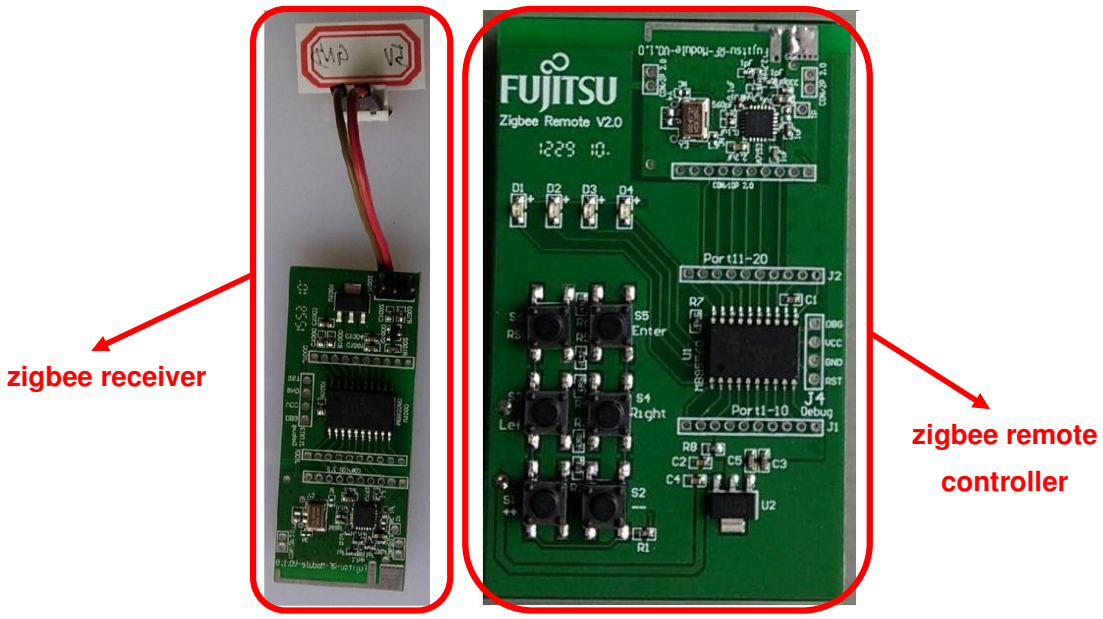


Figure 3-4: Zigbee Module

Zigbee remote controller is powered by 3 cells bailing, which is shown in figure 3-5.

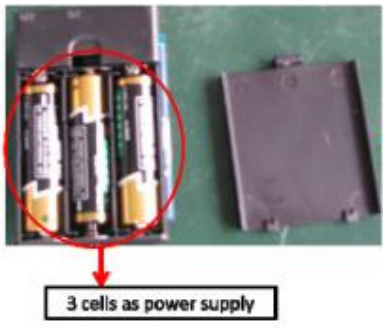


Figure 3-5: Power of Zigbee remote controller

The description of each part of zigbee remote controller is shown in figure 3-6. And the function descriptions of the controller are shown in the following table.

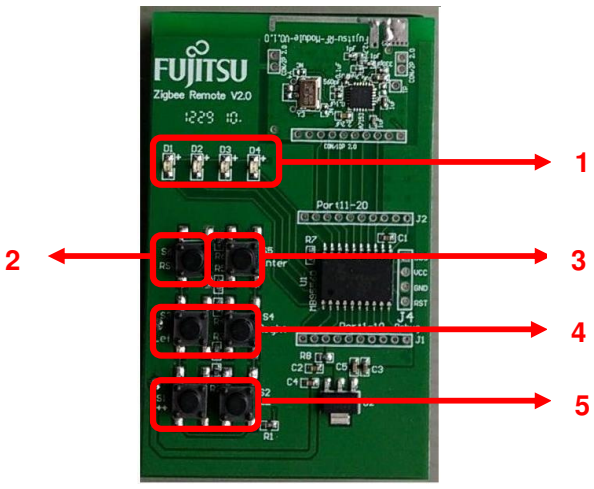


Figure 3-6: Zigbee remote controller description

Number	Port Designator	Description
1	D1-D4	Which LED lighting means that the corresponding bulb is lighting
2	S6	The key is not defined
3	S5	It means all lighting bulbs are chosen or not
4	S3-S4	With the "Left" and "Right" key, you can chose which bulb is lighting
5	S1-S2	Press the "++" or "--" key, you can control the bulb brighter or darker

3.2 System Connection

Step 1

Connect zigbee receiver to the power box, shown in figure 3-7.

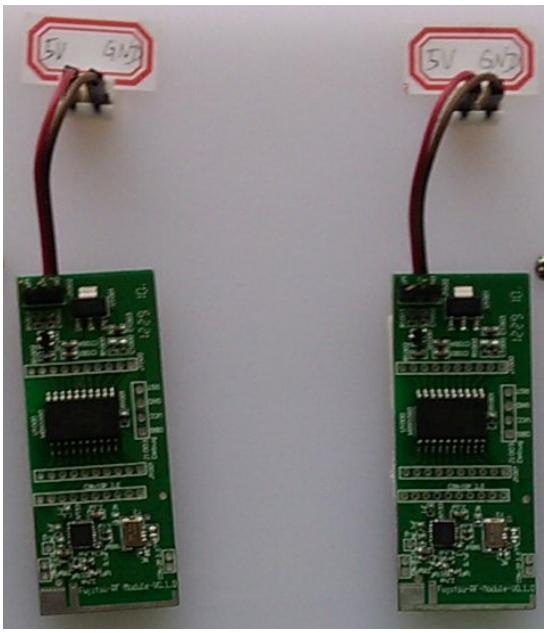


Figure 3-7: step 1- Connect zigbee receiver

Step 2

Install the lighting bulb on the box, and it is shown in figure 3-8.

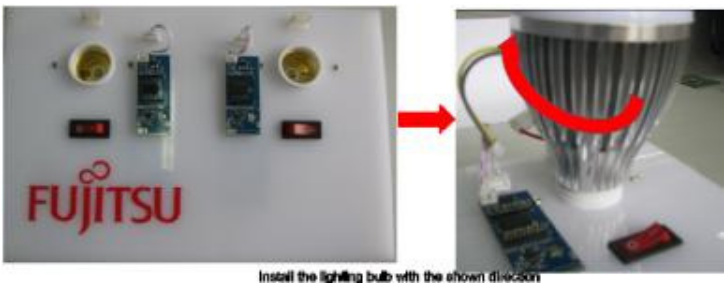


Figure 3-8: step 2-Install lighting bulb

Step 3

Connect lighting bulb to zigbee receiver and load. See it in figure 3-9.

Figure 3-9: step 3-connect zigbee receiver and load

Step 4

Connect the power wire to the electrical outlet as shown in figure 3-10.

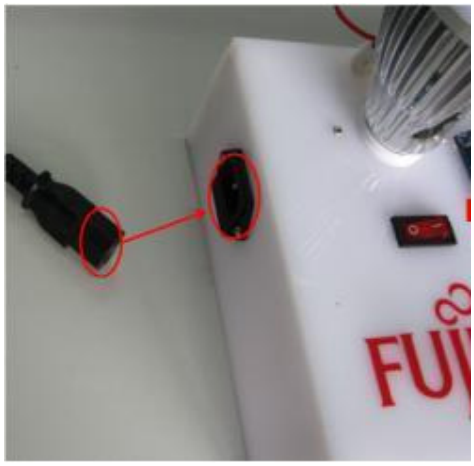
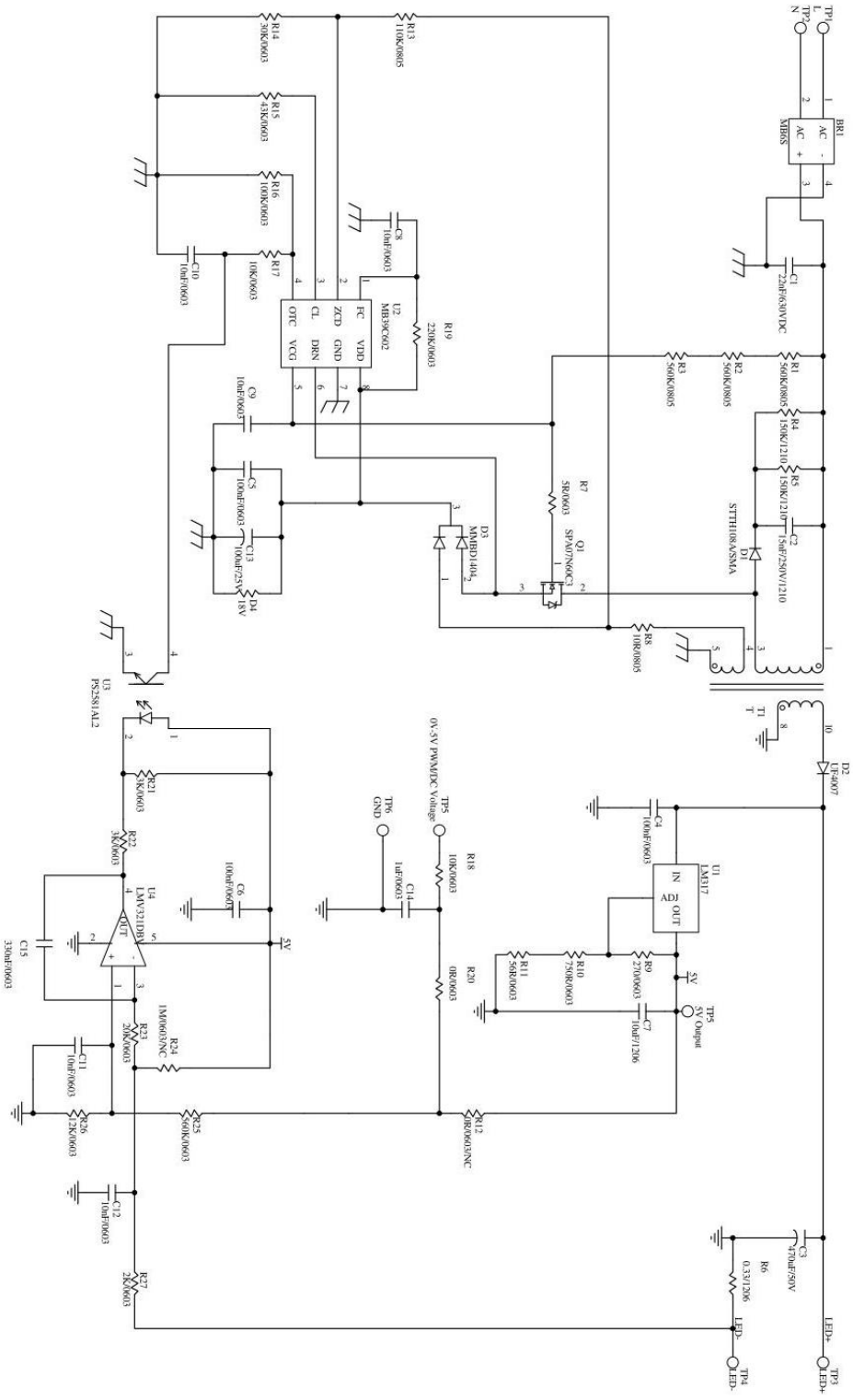


Figure 3-10: step 4-Connect power supply

4 LED Driver schematic and Layout

4.1 LED Driver schematic



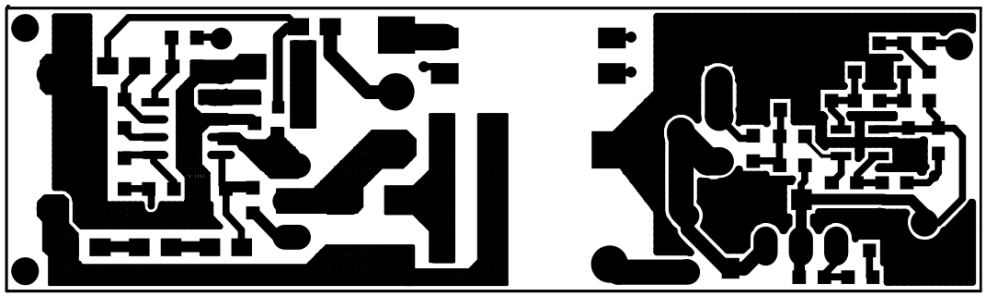
4.1.1 LED Driver bomlist

Here is the bomlist for LED Driver board.

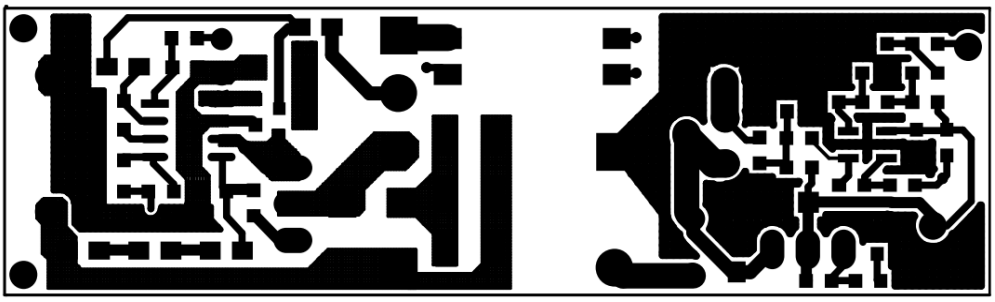
Count	Designator	Description	Footprint	MFR
1	C1	Capacitor, polyester film, 22 nF, 630 V, ±10%		Std
1	C2	Capacitor, ceramic, 0.015 µF, 250 V, ±10%	1210	Std
5	C8,C9,C10, C1,C12	Capacitor, ceramic,10nF,50V,X7R , ±10%	0603	Std
3	C4,C5,C6	Capacitor, ceramic,100nF,50V,X7R , ±10%	0603	Std
1	C7	Capacitor, ceramic, 10 µF, 50 V, X7R, ±10%,	1210	Std
1	C15	Capacitor, Ceramic, 0.33 µF, 16 V, X7R, ±10%,	0603	Std
1	C14	Capacitor, ceramic,1uF,25V,X7R , ±20%	0603	Std
1	C13	Capacitor, aluminum, 100 µF, 25 V, ±20%,	RB.1/.2	Std
1	C3	Capacitor, alumninum electrolytic, 470 µF, 50 V, ±20%	RB.2/.4	Std
1	R6	0.33,±1%	1206	Std
1	R20	0R	0603	Std
1	R12	0R,Not populated	0603	Std
1	R24	1M,Not populated	0603	Std
1	R27	2K/0603	0603	Std
2	R21,R22	3K,±5%	0603	Std
1	R7	5R,±5%	0603	Std
2	R17,R18	10K,±5%	0603	Std
1	R8	10R,±5%	0805	Std
1	R26	12K,±1%	0603	Std
1	R23	20K,±1%	0603	Std
1	R14	30K,±1%	0603	Std
1	R15	43K,±1%	0603	Std
1	R11	56R,±1%	0603	Std
1	R16	100K,±1%	0603	Std
1	R13	110K,±1%	0805	Std
2	R4,R5	150K,±5%	1210	Std
1	R19	220K,±1%	0603	Std
1	R9	270,±1%	0603	Std
1	R25	560K,±1%	0603	Std
3	R1,R2,R3	560K,±5%	0805	Std
1	R10	750R,±1%	0603	Std
1	U1	LM317	TO-220F	NS
1	U4	LMV321DBV	SOT-235	TI
1	BR1	MB6S	MB6S	Std
1	U2	MB39C602,LED driver IC	SOP-8	FUJITSU
1	D3	MMBD1404,Diode, ultra fast, 200 V,	SOT-23	Fairchild
1	U3	Optocoupler,PS2581AL2	PS2581L2	NEC
1	Q1	SPA07N60C3,MOSFET N-channel, 650 V, 7.3 A,	TO-220FP	Infineon
1	D1	STTH108A,Diode, ultra fast, 800 V, 1 A, STTH108A	SMA	ST
1	T1	Transformer flyback, EE20/10/6		Std
1	D2	UF4007,Diode, GPP fast, 1 A, 1000 V,	DO-41	Std
1	D4	ZENER Diode,18V		Std

4.1.2 LED Driver PCB layout

Top view



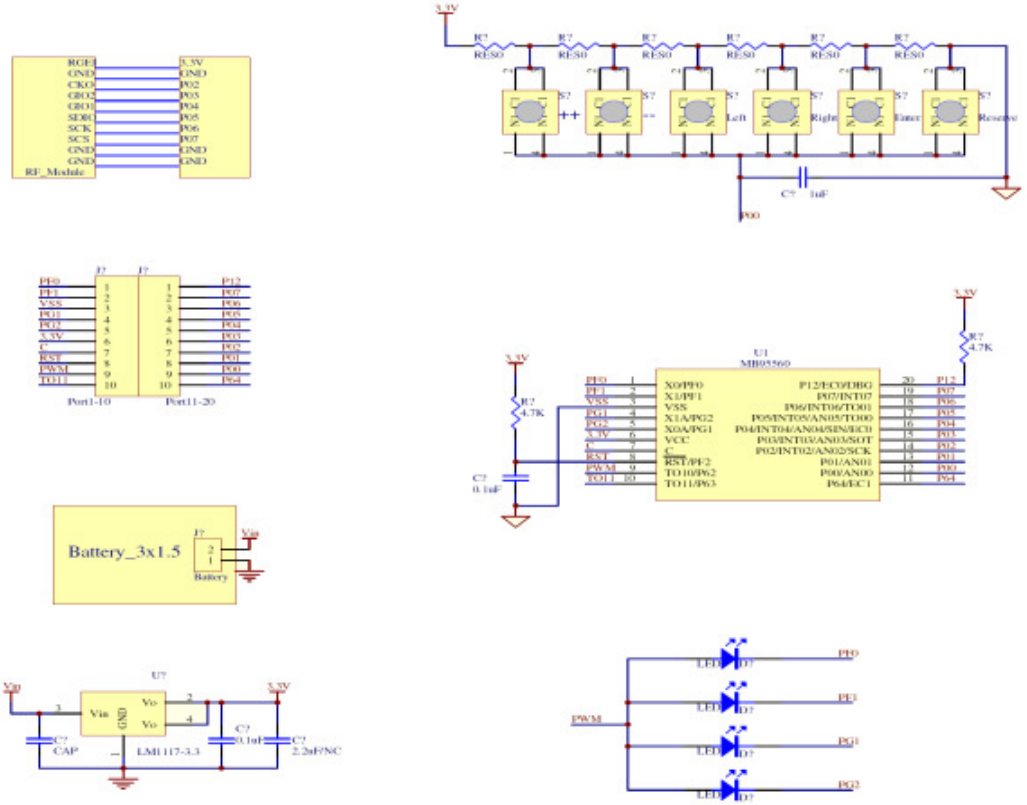
Bottom view



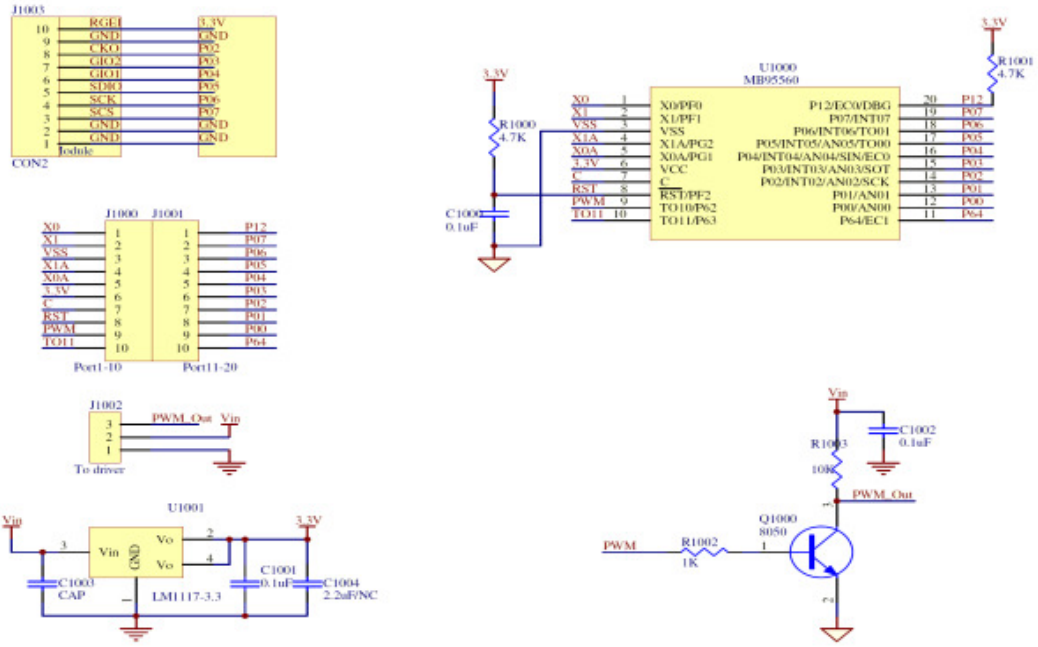
4.2 Zigbee control schematic and Layout

4.2.1 Zigbee control schematic

A、Remote Board



B、Node Board



4.2.2 Zigbee control Bomlist

Count	Designator	Item Specification	Part Type	Footprint	Description
4	C1003	0.1uF	0.1uF	0603	Capacitor
	C1001	0.1uF	0.1uF	0603	Capacitor
	C1000	0.1uF	0.1uF	0603	Capacitor
	C1002	0.1uF	0.1uF	0603	Capacitor
1	C1004	2.2uF	2.2uF	0603	Capacitor
1	R1002	1K	1K	0603	Resistor
2	R1000	4.7K	4.7K	0603	Resistor
	R1001	4.7K	4.7K	0603	Resistor
1	R1003	10K	10K	0603	Resistor
1	Q1000	8050	8050	SOT-23	Transistor
1	U1001	LM1117-3.3	LM1117-3.3	SOT-223	LDO
1	U1000	MB95560	MB95560	SOP20	MCU
23	J1000	Port1-10	Port1-10	HDR10_2.0	Header pin
	J1001	Port11-20	Port11-20	HDR10_2.0	Header pin
	J1002	To driver	To driver	HDR3_2.0	Header pin
6	S1	++	++	B4P	Key
	S2	--	--	B4P	Key
	S6	Reserve	Reserve	B4P	Key
	S4	Right	Right	B4P	Key
	S5	Enter	Enter	B4P	Key
	S3	Left	Left	B4P	Key
3	C2	0.1uF	0.1uF	0603	Capacitor
	C3	0.1uF	0.1uF	0603	Capacitor
	C4	0.1uF	0.1uF	0603	Capacitor
1	C5	2.2uF	2.2uF	0603	Capacitor
2	R7	4.7K	4.7K	0603	Resistor
	R8	4.7K	4.7K	0603	Resistor
7	C1	3.3K	3.3K	0603	Resistor
	R6	3.3K	3.3K	0603	Resistor
	R5	3.3K	3.3K	0603	Resistor
	R2	3.3K	3.3K	0603	Resistor
	R1	3.3K	3.3K	0603	Resistor
	R4	3.3K	3.3K	0603	Resistor
	R3	3.3K	3.3K	0603	Resistor
1	J3	Battery	Battery	BT	Battery

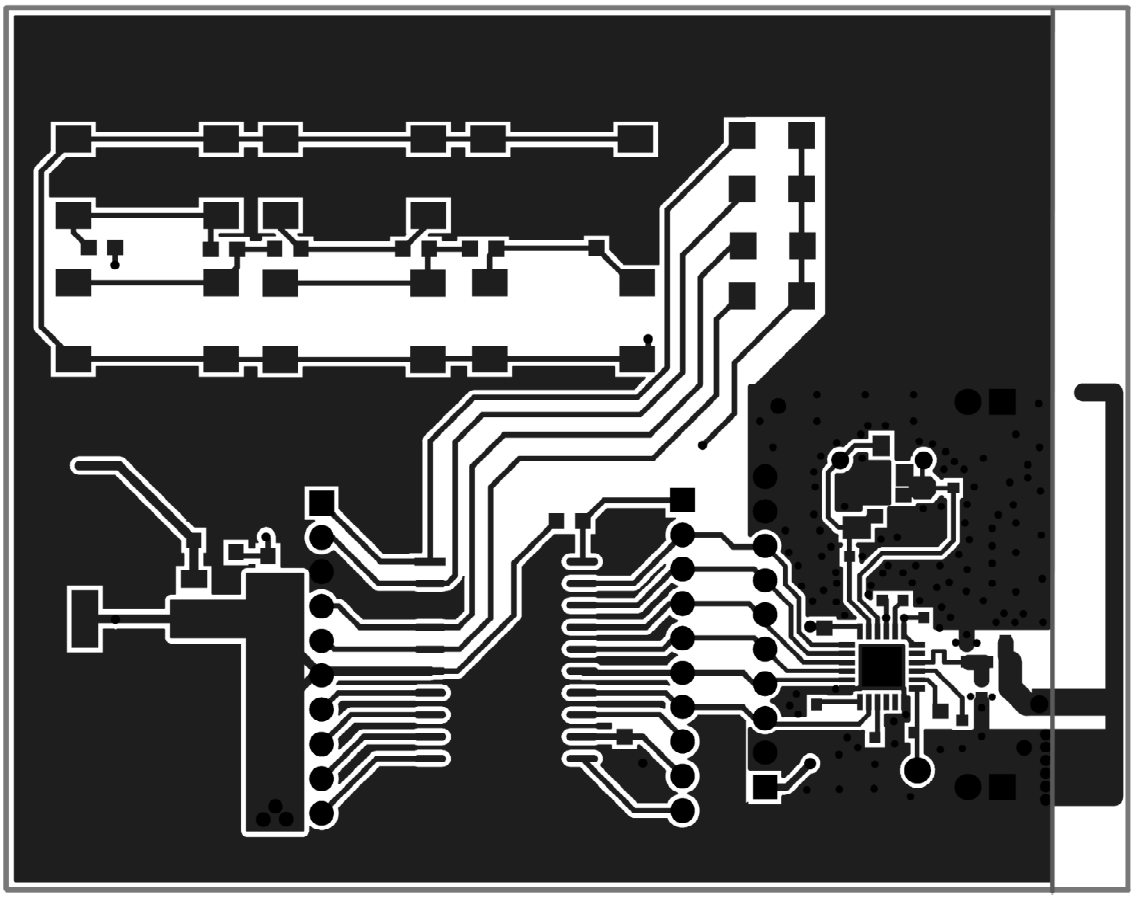
(Continued)

Count	Designator	Item Specification	Part Type	Footprint	Description
4	D2	LED	LED	1206	LED Green
	D3	LED	LED	1206	LED Green
	D1	LED	LED	1206	LED Green
	D4	LED	LED	1206	LED Green
1	U2	LM1117-3.3	LM1117-3.3	SOT-223	LDO
1	U1	MB95560	MB95560	SOP20	MCU
20	J1	Port1-10	Port1-10	HDR10_2.0	Header pin
	J2	Port11-20	Port11-20	HDR10_2.0	Header pin

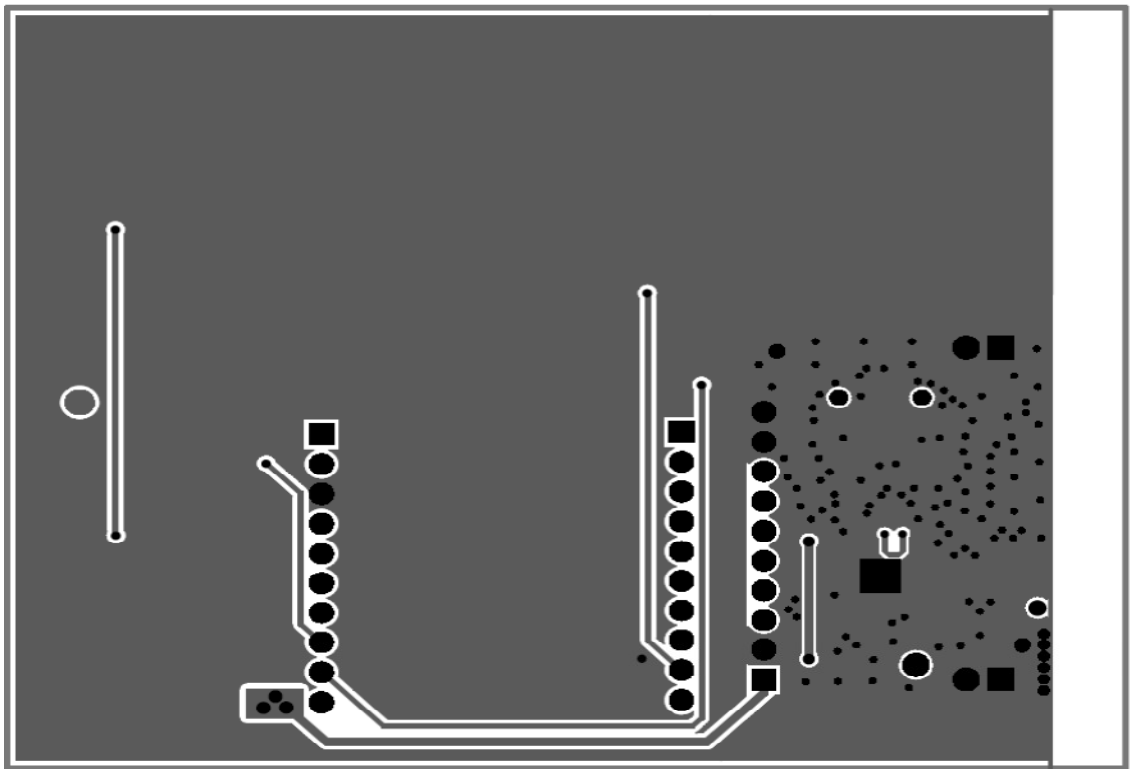
4.2.3 Zigbee control Layout

A、Remote Board

Top view

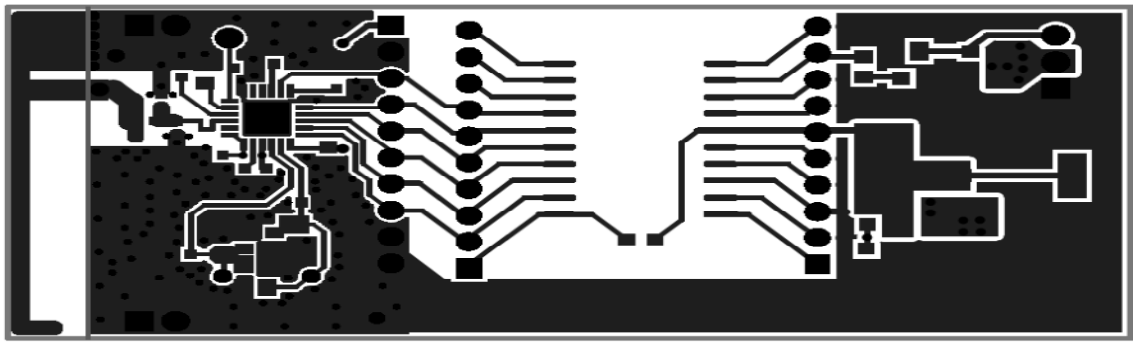


Bottom view

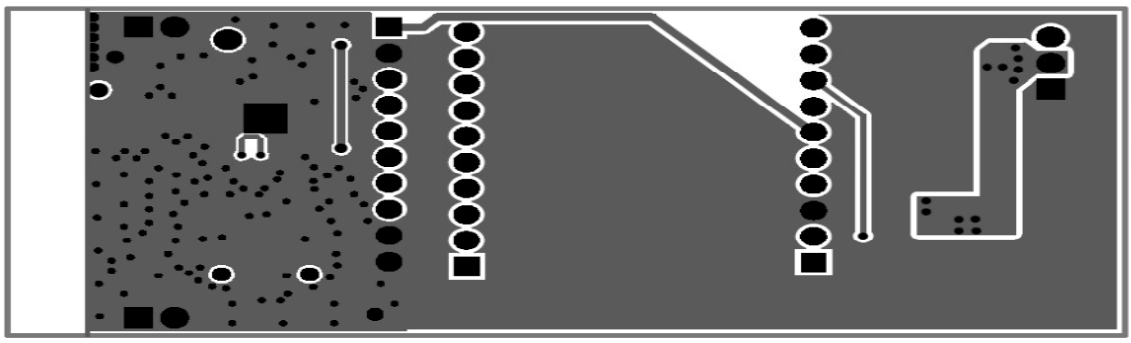


B、Node Board

Top view



Bottom view



————————————END————————————